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Space Act Agreement to Keep Earth Science Program Aloft

By Dewayne Washington

A Space Act Agreement signed between NASA's Remote Sensing Earth Science Teacher Program (RSESTeP) and the Academy of Model Aeronautics (AMA) will allow certified Earth science teachers nationwide to continue to bring NASA Remote Sensing resources into their classrooms.

Dr. Nicholas White, Director of the Sciences and Exploration Directorate, signed the agreement. RSESTeP provides science teachers the opportunity to expose 4th through12th grade students to NASA cutting edge resources and technologies. Members of the AMA can now partner with local schools to fly NASA remote sensing payloads, collecting Earth science data needed to complete classroom projects.

"The collaboration with the AMA will significantly pave the road to expanding NASA's RSESTeP program to many more schools around the country," said Patrick Coronado, NASA RSESTeP Project Manager.

Each year, teachers submit ideas for local Earth science missions to RSESTeP. Those selected are invited to spend a week during the summer at Goddard developing their missions. The training syllabus includes the basics of remote sensing, Earth Observing Satellite Data Product Acquisition, ground-truthing data collection, and more.

Students participating in the program are excited about experimenting with real science. "RSESTeP provides us another opportunity to engage and excite teachers, students, and even communities about the fascinating work that is accomplished here," said Dr. Robert Gabrys, Director of Goddard's Education Office. "I know the RSESTeP team is very excited about working with AMA, assisting mission teachers in completing the flight components of their missions."

Photos provided by RSESTeP

Caption: Students prepare a plane for a science mission.

The program started in 2005 and currently has RSESTeP teachers in 21 states engaging local students and communities while providing valued Earth Science data.

The AMA began in the mid-1930s providing an opportunity for young people to improve their technical skills as a gateway to careers in math, science, and engineering. "The Academy of Model Aeronautics is very excited about the collaboration that this memorandum of agreement represents," said Dave Mathewson, president of AMA. "This is another opportunity for our clubs to give back to the community and we are delighted to have a chance to play a significant role in this important NASA project."

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Cover caption: Matt Opeka lends a hand on his 80th birthday at a symbolic tree planting in his honor.

Image credit: NASA/Goddard/Chris Gunn

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Christyl Johnson Named New Goddard Deputy Center Director for Science and Technology

By Mark Hess

Goddard Center Director Rob Strain has named Christyl Johnson to be the new Deputy Center Director for Science and Technology. Johnson's previous position was the Agency's Assistant Associate Administrator in the Office of the Administrator at NASA Headquarters. In this role, she assisted the Associate Administrator in the oversight of NASA's technical mission areas and field center operations.

In her new post at Goddard, Johnson will manage the research and development portfolio, and will be responsible for formulating the Center's future science and technology goals and leading an integrated program of investments aligned to meet those goals.

"The Deputy Center Director for Science and Technology is an enormously important job at Goddard," says Strain. "Christyl will be our chief strategist for charting the cutting-edge technologies we want to invest in to maintain our technical leadership, the new projects we want to pursue, and the partnerships we want to form with government, academia, and the private sector. Christyl brings a wealth of knowledge and experience to the post, both on the technical and policy sides, and we are extremely pleased she will be joining us."

Johnson will begin this new role at Goddard on December 6, following a 2-year detail to the White House, Office of Science and Technology Policy, as Executive Director of the National Science and Technology Council. In this role, she worked with Administration officials to coordinate science and technology policy across the Federal Government, and to establish clear national goals for Federal science and technology investments in a broad array of areas across the executive branch, including basic science, technology, energy, environment, natural resources, and homeland and national security.

Prior to being named NASA's Assistant Associate Administrator in the Office of the Administrator, Johnson served as the Deputy Chief Engineer for Program Integration and Operations in the Office of the Chief Engineer. She provided an integrated focus for the development, maintenance, and implementation of Agency engineering and program/project management policies, standards, and practices.

Before that, Johnson worked in the Office of Earth Science as the Associate Director for Exploratory Missions, where she managed the formulation and development for all Exploratory Missions, and was involved in mission development activities with Goddard, the Jet Propulsion Laboratory, Langley Research Center, and several international and industry partners.

Johnson began her NASA career as a summer intern in 1985 at the Langley Research Center in Hampton, Va., in the Remote Sensing Technology Branch, assisting in designing and building laser systems for advanced active remote sensors. She has held a number of senior engineering, project management, and organizational management positions at Langley involving the design, development, and application of state-of-the-art and advanced systems and subsystems for atmospheric, aeronautic, and space flight research missions.

Photo credit: NASA

Caption: New Goddard Deputy Director for Science and Technology, Christyl Johnson.

Johnson has received numerous awards, including the NASA Office of Earth Science Terra Award—Enterprise MVP, the National Technical Association's Outstanding Woman in Science award, and the National Celestial Torch Award for Distinguished Engineer in Aerospace.

Johnson has a bachelor's degree in physics from Lincoln University in Pennsylvania, and a master's degree in electrical engineering from the Pennsylvania State University. She is finishing a Ph.D. program in systems engineering at the George Washington University in Washington, D.C.

Born in North Carolina, she now resides in Woodbridge, Va. Johnson and her husband, Darryl, have a 12-year-old son named Jerrin. When she is not working or studying, she enjoys spending time outdoors and traveling with her family. ■

Earth Observing-1: Ten Years of Innovation

By Holli Riebeek

Scheduled to fly for just a year, designed to last a year and a half, *Earth Observing-1* (EO-1) celebrated its tenth anniversary on November 21, 2010. During its decade in space, the satellite has accomplished far more than anyone dreamed.

"Earth-Observing-1 has had three missions," says mission manager Dan Mandl of Goddard. Its original mission was to test new technologies, a mission completed in the first year. Its second mission was to provide images and data. Its third mission was to test new cost-saving software that operates the satellite semi-autonomously and allows users to target the sensors.

All of the missions come down to one thing: "We're the satellite people can try things on." Mandl calls EO-1 "NASA's on-orbit test bed" and the name rings true.

EO-1 was commissioned as part of NASA's New Millennium Program, set up to develop and fly technology that would reduce the risk and cost of future science missions. In short, NASA told its engineers: find a way to fly faster, better, and cheaper.

"EO-1's primary purpose was to demonstrate that the Advanced Land Imager (ALI) was a suitable follow-on instrument for *Landsat*," says Bryant Cramer, the Program Manager at Goddard during EO-1's development and launch. Like *Landsat-7*, ALI records seven wavelengths of light reflected from Earth's surface. ALI also records an additional two wavelengths to improve measurements of coastal waters, aerosols, and forests and crops.

Photo credit: NASA/Robert Simmon

Caption: The ALI instrument on NASA's EO-1 satellite captured a volcanic plume from Krakatoa on November 17, 2010.

Later, an innovative new instrument, the Hyperion imaging spectrometer, was added to the mission. Hyperion records more than 200 adjacent wavelengths of light to even better understand the makeup of Earth's surface.

"EO-1 succeeded beyond anyone's expectations," says former Project Scientist Steve Ungar of Goddard. He credits the mission's success to EO-1's "crackerjack" team of engineers and scientists, who were drawn to the mission because they recognized that they could have a stake in the future of satellite technology.

"Hyperion is probably the future of remote sensing," says Cramer. Hyperion is a hyperspectral instrument, a change in technology that is like going from black-and-white to color television, Mandl adds.

Other remote sensing instruments—multispectrometers—measure discreet wavelengths of light. It is as if your eyes could only see red and blue light; you could tell much about the world based on how much red and how much blue you saw, but your vision would have gaps in the green tones. A hyperspectral instrument corrects this color blindness by measuring many more wavelengths of light.

The science behind the hyperspectral instrument is spectroscopy, says current EO-1 Project Scientist, Elizabeth Middleton of Goddard. "Spectroscopy is the study of constituents of materials using specific wavelengths," she notes. "Hyperion measures the chemical constituents of Earth's surface."

Space-based imaging spectroscopy enables a wide range of science, including tracking the amount of carbon that plants take out of the atmosphere everywhere from the Amazon Rainforest to the Alaskan tundra. It also has been used to find evidence of microbial life in the Arctic and to monitor volcanic activity.

Perhaps the most important thing Hyperion has done, says Middleton, is teach the community how to work with complex hyperspectral data. Germany will soon launch the next hyperspectral instrument, the *Environmental Mapping and Analysis Program* (EnMap), followed by NASA's *Hyperspectral Infrared Imager* (HyspIRI) satellite, which is still in the planning stage. Both missions build on lessons learned from Hyperion.

The Advanced Land Imager (ALI) was built, says Cramer, to test new technology and to provide a safe technology shift for future *Landsat* missions. The Landsat series of satellites has provided a continuous record of changes in Earth's landscape from 1972 to the present.

ALI differs from previous *Landsat* sensors because of how it takes images. Previous *Landsat* instruments scanned from side to side, like a whiskbroom. The image is built from horizontal strips of information. ALI, on the other hand, is more like a push broom. It has detectors arranged parallel to one another and facing forward, and they collect information in vertical strips. This arrangement eliminates the need for the sensor optics to move from side to side, and fewer moving parts means less chance of failure, says EO-1 engineer Stuart Frye of Goddard.

After ten years of operation, ALI has proven that the push broom technology is stable and reliable enough that the next *Landsat* satellite uses the same design. "The *Landsat* community is treating push broom sensors like we've been building them for years," says Cramer. "That's a tribute to EO-1."

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Earth Observing-1: Ten Years of Innovation

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As the EO-1 mission has aged, perhaps the most critical innovation has come from the onboard computer. "EO-1 has two separate computer processors with 256 megabytes of extra memory each," says Mandl. "It meant we had excess capacity to try new things."

The first new software loaded onto EO-1 was the Autonomous Science Experiment, an onboard intelligent scheduling tool that allows the satellite to decide for itself which images Hyperion and ALI should take. The onboard scheduler prioritizes requests based on purpose (ranked by theme) and the weather.

"It's a customer-driven method of running a mission," says Mandl. Anyone from an archeologist to a disaster response agency can request images. "Flying a mission with a customizable user experience is one of EO-1's greatest achievements."

Sometimes the "customers" targeting EO-1 are other satellites. As part of SensorWeb, EO-1 automatically acquires images that are triggered by other satellites. For example, EO-1 monitors 100 volcanoes. When another satellite detects a hot spot at any of them, EO-1 automatically acquires an image on its next overpass. Hyperion records the temperature and position of lava flows, while ALI tracks ash plumes.

SensorWeb and the scheduling tool have saved money. "Initially, we were spending about $7,500 per image to acquire them. Now the cost is less than $600 a scene," says Cramer.

"EO-1 is one of the cheapest of NASA's Earth missions," confirms Middleton. These cost savings mean that anyone can now target EO-1 and access all data free of charge, making it useful to a growing range of people.

"EO-1 has done so many different things, NASA got three or four missions for the price of one," says Cramer. "We achieved all of the things that we hoped for and then some."

For more information about NASA's EO-1 satellite, visit: http://eo1.gsfc.nasa.gov. ■

Tree Planting Recognizes 48 Years of Service

By Maureen Disharoon

Matt Opeka, Senior Advisor on the Program Analysis and Control (PAAC III) contract, began his career with NASA in February, 1962. He was instrumental in the success of many missions whose flight hardware was processed through the Integration and Test facilities in the building 7-10-15-29 complex at Goddard. In the 1970s–1980s, Opeka ran the operations and kept flight hardware testing on a tight schedule to meet mission launch dates.

According to Tom Huber, former Director of Engineering, "Matt always kept the Test and Evaluation (T&E) facilities in exceptional shape, which was not only vital to the success of many missions, but also allowed the facilities to be used by outside vendors."

Jim Barrowman, former Explorers Program Manager and GAS Mission Manager recalled, "Matt was able to establish warm relations with the Goddard project managers while at the same time tapping them for contributions for T&E and shop projects he was pursuing. Any time you approached him for help he always bent over backwards to make sure you got what you needed and then some."

Photo credit: NASA/Goddard/Chris Gunn

Caption: Matt Opeka with friends and colleagues at site dedication for tree in front of Building 29.

John Boeckel, also a former Director of Engineering, remembers Matt as the "backbone of mechanical testing during the 1970s and 1980s." His "get it done" attitude and his high standard of ethics were the hallmark of his achievements at Goddard.

Matt retired as a civil servant in 1988 and continued his work at Goddard on the FPDMSS and SEIMSS contracts in senior management positions. Matt later became a Senior Advisor on the PAAC II contract and continues in that role today.

The current PAAC III Program Director, Bill Gallagher, stated, "Whether Matt was your boss, your customer, your mentor, your employee, or our friend, he made you better. I am the luckiest guy in the world to be able to call Matt my mentor, my boss, my employee, my customer, and my friend."

Matt's 48 years of outstanding expertise and dedication to Goddard and to NASA were honored on December 10—his 80th birthday—with a site dedication ceremony marking the spring planting location of an oak tree in front of the Integration and Test Facility at Building 29. ■

NASA Chief Technologist Braun Talks Technology

By Lori Keesey

Bobby Braun, in his first official visit to Goddard as NASA's Chief Technologist, confirmed his commitment to investing in new technology, but said infusing truly advanced technology into spaceflight missions would require a culture change at NASA.

"Project managers are paid to worry about their projects," Braun told employees December 2. "It might require us to change our culture a bit so that infusion of new technology is not entirely a project manager's call. These strategic decisions need to be made by program managers and the Agency's senior leadership. To get the future we all want, we have to be willing to take informed risk," Braun said.

Human spaceflight, however, would not be an area where high-risk technologies would be tried unless they were already proven in orbit, according to Braun. For small science missions and technology-development activities, though, Braun said NASA should consider a higher level of risk acceptance.

Appointed to NASA's top technology job earlier this year, Braun made his remarks at an "Open Session" with employees, sponsored by the Goddard Office of the Chief Technologist (OCT) as part of the their "Goddard Innovates!" celebration. "It was great to see such a strong turnout and interest by Goddard employees in NASA's technology plans for the future," Braun said.

Photo credit: NASA/Goddard/Chris Gunn

Caption: Scientist Keith Gendreau shows NASA Chief Technologist Bobby Braun a modulated X-ray source, a key component in an X-ray communication system and other instruments he is developing.

The day's activities also included OCT's annual poster session and the award of the 2010 "IRAD Innovator of the Year" award. This year, the organization's top prize went to Technologist John Hagopian and the Nanostructures for Stray Light and Diffraction Suppression team.

Team members receiving the award were: Jim Butler, Georgi Georgiev, Stephanie Getty, Hagopian, Greg Hidobro, Cleophus Hunt, Mary Li, Alex Maldonado, Manuel Quijada, Patrick Roman, Ron Shiri, June Tveerem, and Edward Wollack. They team got the award for groundbreaking work developing a nanotechnology-based material 10 times more effective than black paint used by instrument developers to suppress errant light. Stray light can obscure the faint signals scientists are trying to gather—a particular challenge for ocean-monitoring instruments and future planet-finding missions.

Photo credit: NASA/Goddard/Chris Gunn

Caption: John Hagopian (left) and his 12-member Nanostructures for Stray Light and Diffraction Suppression team received this year's "IRAD Innovator of the Year" award for groundbreaking work in a new light-suppression technology. Goddard Deputy Director Rick Obenschain (center) and NASA Chief Technologist Bobby Braun were on hand to present the award

"Our job is to develop and advance new technology that will ultimately result in new missions and improved scientific measurements," said Goddard Chief Technologist Peter Hughes, explaining why his organization chose the team for the annual award. "Goddard has a well-deserved reputation for creating technologies that enhance instrument performance because we are adept at quickly infusing emerging technology for specific spaceflight applications. John's team demonstrated that key strength. And in doing so, he's leading the way in NASA's quest to bring about a new level of scientific discovery," Hughes said.

Braun, who was on hand for the awards presentation, earlier in the day spoke to employees who packed the Building 3 auditorium to learn more about NASA's plan to reinvigorate technology research and development. Since assuming his job, Braun and his team have laid out a multifaceted "Space Technology Program" aimed at providing seed funding to develop advanced technologies and experimental flight opportunities to advance their readiness levels.

"The piece of legislation to focus on is the NASA Authorization Act of 2010," Braun said in response to a question regarding the present uncertainty over NASA's budget. "We are ready. The planning is largely complete," Braun told employees. In the meantime, he urged employees to "spend time thinking of the future you would want to create for NASA. I want you to think about the investments we need to make today to enable the exciting missions in NASA's future."

Those ideas then should be proposed in future calls for proposals under the Goddard Internal Research and Development (IRAD) program or NASA's technology-development programs, once they receive funding, according to Braun.

For more information about the Office of the Chief Technologist and its initiatives, visit: http://www.nasa.gov/oct. ■

Filling the Void: Goddard Calls for Mentors to Inspire a New Generation

By Christina Coleman

With a significant percentage of Goddard's workforce eligible for retirement, the pressure is on to inspire and recruit a new generation of scientists and engineers. Fortunately, over 443 employees, including contractors and civil servants at GISS, Greenbelt, IV&V, and Wallops, volunteered to be mentors for students this past summer; a move that opens up the pipeline and gives students the opportunity to grow in a professional environment.

"Internships and apprentices are vehicles for hiring," said David Rosage, a Program Manager in the Higher Education Unit. "We're trying to inspire, excite, and help shape students careers."

In what used to be an extensive process, science and engineering mentors can now post internship and fellowship opportunities to the new NASA-wide integrated system, One Stop Shopping Initiative (OSSI). From there, students can access the Student Online Application for Recruiting Interns (SOLAR), which consolidates information found on multiple NASA sites and allows students to apply for up to 15 jobs at any NASA Center.

And even though 443 seems like a large number of mentors, Rosage is hoping that more scientists and engineers participate and put more opportunities on the SOLAR application system.

"The Agency-wide workforce will depend on OSSI," Rosage said. "It would be nice to see some new folks mentor. We're anticipating a high volume of applicants."

In fact, the system, which just opened up November 2010, already has 200 completed applications from students. That's one of the reasons why Paul Mason, an aerospace engineer in Code 540, is putting out another call for mentees this year.

"At Goddard, we're not just here to get a paycheck," Mason said. "We're here to create and inspire. Think back to what you were like as a student. The little insight that a mentor gave you can go a long way."
This past summer, Mason had three students working on analysis modeling and competition fluid dynamics. While he agrees that taking on a student can be a bit daunting, the extra work certainly pays off.

"Taking on an intern is beneficial for the entire Division from a couple of aspects. Intellectually, possible hires or collaborations," Mason said. "We're getting that 'Let's share ideas' mentality into the world."

"Mentoring is one of those things that at first glance seems like it will take too much of your time, or be a burden for your summer, but when you do it once and have the chance to see how much fun it is to 'light the fire' of just one young student, you see the payoff," said Nancy Carosso, Chief Engineer for the Contaminations and Coatings Engineering Branch. Formerly, Carosso worked with Rosage in the Office of Higher Education to match incoming interns with challenging engineering and science projects.

"I wanted to participate because it's a fabulous opportunity to energize this generation of students and to give them hands-on experience with designing, assembling, analyzing, and testing hardware for real space missions. We are lucky here at Goddard to have so many spacecraft and instrument missions to offer these work experiences to young interns. And there's a personal payoff in knowing that you helped even one person in their career quest for one summer of their life," she added.

For both Mason and Carosso, ensuring that their student interns grew tremendously throughout the duration of their stay was paramount for not only the student, but for the Agency. "I think that at GSFC we try to disseminate knowledge. The stuff that we do here, the students will take it and either work here or create spin-offs," Mason said.

But what was equally important was knowing that they too would benefit from the relationships cultivated over the summer. Gaining leadership experience, getting help with projects, and even getting a new perspective and fresh ideas on their work were some of the highlights of sponsoring an intern. "When someone you mentor becomes successful, their achievements are more rewarding than your own," Mason said.

To participate in the mentor program, write a brief summary of the position and post it on the SOLAR Application System Web site. More than one position can be posted by an individual.

"It's really important to come up with a slice of work for the intern," David Rosage said. "There is no obligation to take a student and you can search the entire pool of applicants and pick a student that seems like a good fit," he added. Rosage also added that a lack of funds is not a reason to not put in an opportunity. Space grants from states, among other pools of money, can help fund a student's internship.

"Do it! Just jump in and do it! It's a win-win for both of you. The Office of Higher Education is there to support you if you need help, and they take care of housing, commuting, meals, and other logistics," Carosso said. "So think about the work that you are doing, or that you plan to do this summer, and input it into the SOLAR Web site. Then wait to see the intern applications. Summer is coming quickly!"

For more information on SOLAR and mentoring opportunities, visit: http://intern.nasa.gov. ■

Goddard Engineer to Blog about Upgrades at McMurdo Station

What are you doing for the holidays this winter? Spending time with family and friends?

More than a dozen Near Earth Network engineers and support personnel from Goddard and Wallops Flight Facility will be packing their bags and spending their holidays far away from their families at McMurdo Station, Antarctica, for the austral summer.

McMurdo Station is one of three permanent National Science Foundation (NSF) stations in Antarctica. At McMurdo Station, which is the main U.S. station in Antarctica and 850 miles (1,360 km) north of the South Pole, the mean annual temperature is 0° F (-18° C). Temperatures can reach 46° F (8° C) in the austral summer and -58° F (-50° C) in the austral winter. The average wind is 14 miles per hour, but winds have exceeded 115 miles per hour.

The team will perform crucial upgrades and maintenance activities to the NASA Near Earth Network at McMurdo Ground Station in support of European Space Agency's latest meteorological satellite, *MetOp*, which launched in October 2006. *MetOp-A* is the first in a series of three European meteorological operational satellites procured by ESA to serve as the space segment of the European Organisation for the Exploitation of Meteorological Satellites' EUMETSAT Polar System. Under a memorandum of agreement between NASA and the National Oceanic and Atmospheric Administration, the McMurdo Ground Station's support will begin in March 2011 and also will support *MetOp-B* and *C* over the next 15 years.

In collaboration with NSF, NASA owns and operates a single 10-meter antenna, hidden inside the radome at McMurdo, and associated electronics equipment that has provided countless hours of space-to-ground communications support to dozens of expendable launch vehicles and polar-orbiting satellites owned by NASA, other government agencies, and international partners.

In addition to having a station at McMurdo, the Near Earth Network combines other NASA-owned stations with services purchased from commercially owned stations to provide support to a long list of missions.

The upgrades will involve replacing a majority of the electronics systems in the ground station. The maintenance of the antenna system will involve using a crane to uncap the radome, disassemble the antenna, and replace the antenna pedestal followed by reassembly of the antenna and radome. These activities will allow the Near Earth Network to support not only MetOP but also a host of other future missions.

Photo credit: Seth White

Caption: McMurdo Ground Station radome as seen from Building 71 at McMurdo Station.

Goddard engineer Kevin McCarthy will lead this effort, providing project oversight and coordination with the National Science Foundation. In addition to reporting to Goddard and the Space Communications and Navigation Program on day-to-day activities and status, McCarthy will be the primary blogger for the Near Earth Network McMurdo upgrades while in Antarctica.

"I'm looking forward to my departure on November 6 and my scheduled return home on February 5, 2011, as well as sharing my team's experiences on our work and life at McMurdo," reports McCarthy.

The Near Earth Network is the latest NASA project to join the trend of blogging on day- to-day activities as part of NASA's blog Web site under the title, "Summer on the Ice," which will be updated regularly with news and photos of the site upgrades.

To follow the team's progress, visit: http://blogs.nasa.gov/cm/newui/blog/viewpostlist.jsp?blogname=Summer%20on%20the%20Ice. ■

Goddard, Lockheed Martin Providing Computers to Local County Schools

By Dewayne Washington

Goddard community members and Lockheed Martin representatives recently celebrated a new initiate that provides computer systems to Prince George's County Public Schools.

"We are proud to support Prince George's County Public schools in their efforts to bring enhanced technology education to their students," said Robert Strain, Goddard Center Director. "Through this partnership with Lockheed Martin and the school system, we hope to promote a high-tech learning environment for County students that will encourage the next generation of explorers."

Photo credit: NASA/Goddard/Debora McCallum

Caption: Oxon Hill High School Principal Dr. Jean-Paul Cadet talks to students about the computer upgrades. Center Director Robert Strain, Prince George's County Public Schools Superintendent Dr. William R. Hite, Jr., and Congresswoman Donna Edwards look on.

Local high schools in Oxon Hill, Fairmont Heights, Bladensburg, Bowie, and Northwestern have already received more than 140 pieces of computer equipment. Donations will continue throughout the year as older systems are replaced at Goddard.

Donations of refurbished computers and associated equipment are possible because Lockheed Martin is the primary contractor for NASA's Outsourcing Desktop Initiative (ODIN), responsible for upgrading Goddard computers.

"Lockheed Martin is a longtime supporter of STEM (science, technology, engineering, mathematics) initiatives and is proud that our work on the ODIN program can directly contribute to advancing technology education," said Colleen Leighty, Director of Lockheed Martin's Enterprise Information Technology team. "This agreement will ensure Prince George's County students will have a constant supply of computers to support their learning experiences. We look forward to continuing working with the County and NASA to provide students every opportunity possible."

School officials say many of their computer systems are at least six years old. The donated computers are only three years old and perform much faster and at a higher quality.

"We appreciate the donation of computer equipment from NASA and Lockheed Martin," said Dr. William R. Hite, Jr., Superintendent, Prince George's County Public Schools. "As benefactors of this generous donation, our students will continue to learn on updated technology as they prepare themselves for high school graduation and beyond. It is through partnerships like this that our students will be prepared to compete in the global workforce."

Photo credit: NASA/Goddard/Debora McCallum

Caption: Superintendent Hite and Congresswoman Edwards get computer lessons from Oxon Hill High School students.

This initiative is part of NASA's continuing tradition of investing in the Nation's next generation of explorers. It is directly related to the Agency's educational goal of strengthening NASA's and the Nation's future workforce. NASA continues to partner with national and local programs in support of STEM subjects while developing the critical skills and capabilities necessary for future space exploration. ■

Yihua Zheng: A New Breed of Weather Forecaster

By Karen C. Fox

Solar storms sweeping from the Sun to Earth can damage anything from spacecraft to Earth's electrical utilities. The "Halloween Storm" of October 29, 2003 destroyed the $450 million *Midori-2* research satellite. A storm on March 13, 1989 caused a collapse of the entire Quebec power grid. But such things can be avoided with enough advance warning.

It is 11:15 a.m. on a Friday morning at Goddard and time for Yihua Zheng's daily check on the Sun. She walks from her small office down the hall to the Community Coordinated Modeling Center (CCMC)—a room much more dynamic and colorful than its name suggests. Four large plasma screens on the wall show colorful basketball-sized images of the Sun in real time. Other images feature data from particles as they flow from the Sun to the Earth, or a map of the Sun's magnetic fields.

This is the heart and soul of Space Weather Services at NASA, the team that keeps tabs on the Sun's activities for the entire Agency. It's a mini mission control center of a very new and modern kind. Instead of rows of computers and operators, Zheng controls the images on the screen with a single wireless keyboard and mouse that sits on a table in the middle of the room. She and one of her colleagues, research associate Antti Pulkkinen, scroll through the images on the screen.

"Click forward. Wait, now go back," Pulkkinen says. "Yes, it looks like there's something right there. There's something coming."

That "something" is a burst of material surging up through the Sun's atmosphere. It's not much yet. It could leap up into a giant arch called a coronal loop and then die as quickly as it came. Or, it could become something larger and more powerful: a solar flare or a coronal mass ejection. These kinds of events can send radiation and particles hurtling through space to Earth, to other planets, and out to the edge of our solar system. At best, such events can cause beautiful auroras. At worst they can damage satellites, power grids, and even astronauts in space.

And it's Zheng's job to let everyone know when such a thing is headed towards Earth.

Inheriting the Math Gene

Zheng's path to NASA's Space Weather Services began in a rural part of Henan province in China, an area in the fertile Yellow River basin known for being the cradle of Chinese civilization as well as the birthplace of Lao Tzu and Taoism.

"My father was part of the generation that was wasted by the Cultural Revolution," says Zheng. "He's very good at math, but when he graduated in 1966, the year the Cultural Revolution began, there were 10 years where he couldn't go to college. He stayed and worked in the village."

In 1977, colleges were reopened. Zheng's father went back to school at the age of 30, by then married with two children, and become a math teacher. "I guess I got the math gene from my father," says Zheng.

She was encouraged in math and science ever since elementary school in a culture that honored the sciences. "Being a scientist is very cool and very sacred," says Zheng. "It's almost every child's dream to be a scientist when they grow up."

Zheng attended Beijing Normal University, where she earned her undergraduate and master's degrees in physics. Then, in January 1997, she packed two small suitcases and boarded a plane to the United States. She landed at Logan Airport in Boston, got on a bus to New Hampshire and arrived at the University of New Hampshire, cold, jetlagged, and unsure where her dorm was located.

Eventually, someone pointed her in the right direction and the dorm became a fantastic introduction to grad school life. "Mostly I was just excited to be in a new environment," Zheng says. "The dorm was co-ed; it was a mixture of cultures and majors—a great opportunity to talk about things other than my own work." Indeed, this was where she met her husband, Robert Herschbach, a poetry grad student—whose room was right next door to hers.

Watching the Sun

Thirteen years later, Zheng, her husband, and their two children, now live in Maryland, where in early 2010 Zheng took a job at Goddard to lead NASA's Space Weather Services.

"Space Weather Services provides information to NASA's robotic missions," says Zheng. "We give the mission leads a heads up about what's going on whenever the Sun does something that could be potentially harmful."

The process goes like this: Every morning, or whenever activity flares up, she and her colleagues discuss the Sun and what it's doing. They study images of the Sun from various NASA spacecraft such as the *Solar Dynamics Observatory* (SDO), the *Solar TErrestrial RElations Observatory*, (STEREO) and the *Solar and Heliospheric Observatory* (SOHO).

The Sun's activity is constant. On a calm day, the surface of the Sun might simply show large swirls, a sunspot, or even a long magnetic filament many times the size of the Earth. All of these features can lead to ejections, but no one is sure precisely how. Since about 2008, when solar activity was at its most recent minimum, such features have largely remained serene.

But the Sun is waking up, and Zheng and her colleagues expect to see much more activity as the Sun moves towards its maximum sometime in 2013.

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Yihua Zheng: A New Breed of Weather Forecaster

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One such day of activity was on Sunday, August 1. "Of course, these things have to happen on a weekend," laughs Zheng. The team spotted a large coronal mass ejection bursting out of the Sun's atmosphere. Whenever they spot an ejection, the team immediately uses the tools at the Modeling Center to determine if it's headed toward Earth or other spacecraft such as *Messenger*, which is near Mercury. Solar flares can reach Earth within a few hours and coronal mass ejections within a day or two. Most, however, travel off in harmless directions.

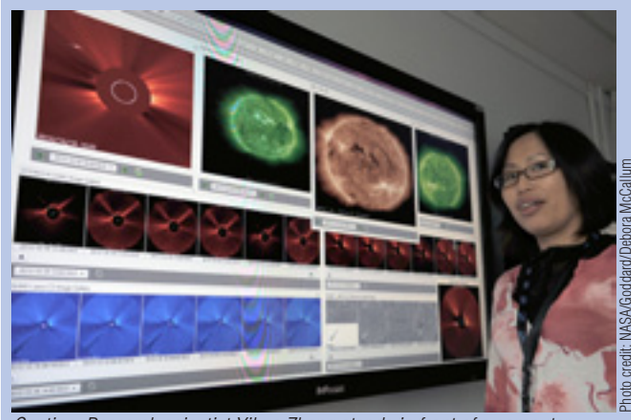

Photo credit: NASA/Goddard/Debora McCallum

Caption: Research scientist Yihua Zheng stands in front of a computer screen at NASA's Goddard Space Flight Center's Coordinated Community Modeling Center that shows real-time images of the Sun taken by three NASA spacecraft.

"We try to get all the parameters from the data," she says. "We get the propagation direction and the speed and the angle, so we can put that all into a model and predict its impact on Earth or other planets and spacecraft."

Once they established a path for this CME—and yes, Earth looked like it was going to receive a direct hit—they sent out an alert to NASA's mission directors who in turn, initiated protocols to shield and protect any vulnerable spacecraft. In addition, Space Weather Services alerted various other organizations, such as the Air Force Weather Agency (AFWA), which incorporates NASA's information with other data into their own forecasts. In turn, AFWA regularly sends valuable information to Goddard to help test their models.

On August 3, about two and a half days later, Earth felt the disturbances from that ejection and experienced a moderate geomagnetic storm—meaning that the largest effect were some pretty auroras. That was what's known as a C-class CME. The next two highest are M- and X-class, which have a much higher chance of affecting power grids on Earth. More than likely, Space Weather Services will be spotting some of those soon.

Space Weather Services at Goddard leverages the latest research results and state-of-the-art models hosted at the Community Coordinated Modeling Center to both protect NASA's spacecraft fleet and improve the U.S. Government's prediction power.

For example, after an event like the one on Aug. 1, Zheng and the team track the event and compare its path to the models' predictions. By checking the accuracy of the models, the group constantly tests and strives to improve the Space Weather Services' abilities.

Being able to predict solar weather even before the first sign of agitation on the Sun's surface, however, remains out of reach. "Sometimes we see several flares in a row within a few hours," Zheng says. "And then we'll have days with nothing. Sometimes we see a CME after a solar flare. Sometimes we don't. We'd love to be able to predict these in advance, but that capability is just not there yet."

In the meantime, Zheng and the Space Weather Services team will be keeping a keen eye on the Sun for us.

For more information about the CCMC and its capabilities, visit: http://ccmc.gsfc.nasa.gov. ■

OutsideGoddard: Stargazer at the Smithsonian

By Elizabeth M. Jarrell

Retired Goddard Space Flight Center Art Director Maceo Leatherwood will have the honor and privilege of seeing his lithograph "Mo'Paklahoma," also known as "Mo'Pak," in the collection of the Smithsonian's National Museum of the American Indian. As expressed in the acceptance letter from the Kevin Gover (Pawnee), Director of the museum, Mo'Pak "now belongs to the American people." Mo'Pak will also be part of a traveling exhibit of both the Smithsonian's National Museum of the American Indian and National Museum of African American History and Culture, called "IndiVisible".

The forward of the companion book "IndiVisible: African-Native American Lives in the Americas," written by Gover and Lonnie G. Bunch, III, Director, National Museum of African American History and Culture, describes the traveling exhibit as more than a repository; it is the beginning of a "conversation," one which is "examining the complicated and very human concept of identity: who we are and where—and to whom—we belong."

Says Leatherwood, "Everything in my life leads to Mo'Pak. Because Mo'Pak is now in the Smithsonian, it is now part of our history."

So who exactly is Maceo Leatherwood? His maternal grandparents were Maryland African-Algonquians. His paternal grandparents were North Carolina Anglo-Iroquoians. Dualism exists everywhere, as it does in him.

Both the man Leatherwood and his art are replete with symbolism. "Hopefully when you look at a painting of mine, you see three or four meanings and statements about life in America," explains Leatherwood.

Leatherwood further explains that "Mo" is a contraction of "Moors" as in the blacks from Northern Africa. "Paklahoma" refers to Oklahoma, the place to which President Jackson removed the Native Americans and their African slaves. "Pak," an acronym which is Leatherwood's personal tribute to his paternal grandfather, is derived from the languages of Southwestern, Plains, and Eastern Woodland tribes. Mo'Pak is one of twelve in a series; the rest of which can be viewed on his Web site.

A zebra merely represents Africa to most people. But, as Leatherwood further explains, "Mo'Pak is about survival. Zebras are all about survival." He pointed out that a type of prehistoric zebra was indigenous to America. Leatherwood concludes that he painted "an indigenous people with an indigenous equine." He notes that it is important that the zebra is moving, traveling.

Leatherwood says, "I love the Sun." The bold color blocks lit by the sun in all directions compose the background. He continues, saying, "I love the images of native chiefs for various reasons." At first glance, the rider appears to be a Chief. But he has no face. "This Indian is a stargazer. His face is the North Star, a stargazer. He is a traveler. All travelers are stargazers. And Hubble, NASA's space telescope, my last and favorite project at Goddard, is also a stargazer," explains Leatherwood. Noting that NASA is represented in most of his paintings, Leatherwood indicates the two star constellations in the upper right quadrant of the painting.

Photo provided by Maceo Leatherwood

Caption: Maceo Leatherwood and Mo'Pak.

He is very careful to point out that the moving zebra and its Chieftain rider are traveling. "The blue at the bottom is a river, which symbolizes travel for most Native Americans," says Leatherwood. He further explains that "the flying Eagle is also traveling." The themes of stargazers and travelers are very important to Leatherwood. "My images always are stargazers. The faces are not masks, they say something more. The stars are beyond you. When you travel, you are always looking for something."

Leatherwood continues, "Stargazing crosses over from all times and all peoples. Hubble looks at stars. The stargazer's face and the stars in the background focus the painting on stars. They call me a traveling artist. I'm described in this painting by three things: stargazing, traveler, and Mo'Pak." He concludes, "Mo'Pak could be my legacy."

How fitting, then, that the traveling artist's traveling stargazer Mo'Pak is in the Smithsonian's traveling exhibit "IndiVisible."

"Mo'Pak" and othe works can be viewed on Leatherwood's Website, at: http://www.maceoleatherwood.com. ■